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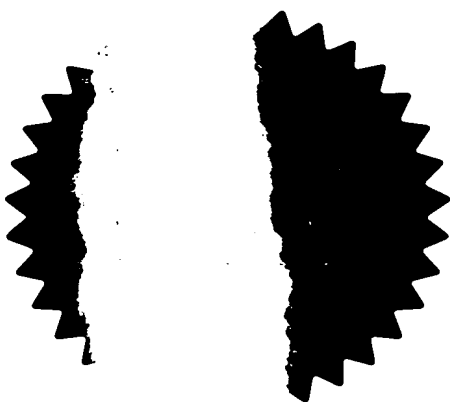
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PA4451

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3. Full name, address and postcode of the or of each applicant (underline all surnames)

Martin BUCKNELL
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Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

8423477001

4. Title of the invention

IMPROVED PAVING SYSTEM

5. Name of your agent (if you have one)

SOMMERVILLE & RUSHTON

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

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IMPROVED PAVING SYSTEM

Field of the Invention

5

The present invention concerns improvements in and relating to paving and particularly to a method and apparatus for applying a settable material such as, for example, cement or concrete to a surface to form paving.

10 Background to the Invention

There have, in recent years, been a number of important developments in the field of paving extending the range of options available for materials and finishes and the way in which the paving is laid. One of the most important developments was the
15 introduction of pattern-imprinted concrete to enable an area of paving to be given the appearance of block paving when, in fact, it is formed *in situ* as a layer of concrete is subsequently coloured and imprinted using a set of moulds for the pattern design, pressed down from above. An example of this system is described in GB 2,193,989A. Among benefits that can be obtained from this process is the
20 ability to obtain a block paved appearance with a substantially monolithic formation that stops through-growth of weeds. Furthermore, the paving can be laid comparatively rapidly and less labour intensively than conventional block paving. However, the level of skill required to lay the pattern imprinted concrete paving is substantially higher than for block paving and there are tight constraints in when and
25 how the pattern-imprinted concrete can be laid.

Laying pattern-imprinted concrete during hot periods should be avoided to prevent accelerated concrete curing which can lead to crack formation. The quality of the installation during hot spells can also be undermined as the installers are under
30 greater pressure to rush the process before the concrete is too hard to work with, i.e. loss of pattern definition.

Given constraints such as the finite curing time window, the need to pattern imprint substantially the full area to be paved in one session in order to avoid unsightly
35 discontinuities in the pattern, to ensure the colour is consistent throughout and the difficulty in rectifying any errors once the pattern has been applied, speed, care and

Suitably there are a number of said one or more apertures and these are formed as crenellation recesses in the upper, in use, edge of the wall between the compartments of the base frame(s).

- 5 Preferably further apertures are formed in the walls between compartments lower down the walls than the crenellation recesses .

- Suitably the crenellation recesses in the walls between compartments are at least partly staggered as they run through the walls, and if fully staggered and thereby
10 occluded are provided only in combination with said further apertures.

One or more recesses may be formed in the walls between compartments lower down the walls than the upper edges of the walls.

- 15 Preferably there is further provided a frame which is of a substantially corresponding shape in plan to the base frame in order to be positioned atop the walls of the base frame in use and which functions as a grout-holding frame or grout channel- forming frame.

- 20 This frame preferably is a grout-holding frame carrying on its face that is to be placed atop the base frame a layer of grouting material, which layer of grouting material is releasably held to the grout-holding frame so that it may be left in place between the paving blocks when the grout-holding frame is removed.

- 25 Alternatively the frame that mounts atop the base frame is a grout channel-forming frame and the frame is formed of or serves as a grouting material.

- In either case the grouting material suitably extends beyond the top edge of the grout-holding frame or grout channel- forming frame into the compartments to be
30 embedded in the settable material.

In any of the embodiments the base frame is particularly preferably of cardboard or other degradable material that will degrade in situ over time.

- 35 According to a second aspect of the present invention there is provided a frame that is of a substantially corresponding shape in plan to a base frame, which base

frame, alone or together with an adjacent positioned said base frame, defines a plurality of compartments within which the settable material may be placed to be moulded by the compartments of the base frame(s) into a plurality of blocks, in order to be positioned atop the walls of the base frame in use and which functions as a grout-holding frame or grout channel-forming frame.

According to a third aspect of the present invention there is provided a method of forming a paving from a settable material and which comprises the steps of providing an apparatus as claimed in any preceding claim, laying it on the surface to be paved, positioning the settable material into the compartments of the apparatus and allowing the settable material to set, embedding the base frame(s) of the apparatus *in situ* in the paving.

Brief Description of the Drawings

Preferred embodiments of the present invention will now be more particularly described, by way of example, with reference to the accompanying drawings, wherein:

Figure 1 is a schematic perspective view from above of a base matrix frame and a grout-holding/channel-forming frame that, in use, is superimposed on the base matrix frame;

Figure 2 is a perspective view from above of a base matrix frame and grout-holding frame such as shown in Figure 1 but showing the grout-holding or "channel-forming" frame operatively positioned on the base matrix frame;

Figure 3 is a close-up perspective view of abutting walls of adjacent base matrix frames clipped one to another;

Figure 4 is a view similar to Figure 2 of a curved base matrix frame and grout-holding frame suitable for providing edging to the paving;

Figure 5 is a schematic transverse sectional view of paving formed using the system of the invention;

longitudinal and transverse border walls 4 and partitioning walls 2,3 of the base matrix frame 1 so as to overlies/cap their upper edges.

5 The grout-holding frame 20 is suitably substantially rigid at least in so far as the mutual spacing of the longitudinal and transverse members is defined, but may have the nature of a sheet that can be stored in a rolled up state and then rolled out over the base matrix frame 1.

10 The skeleton of the grout-holding frame 20 may, like the base matrix frame 1, also be formed of PVA coated card/compressed paper. It carries beneath it strips of grout 23 extending the length of the longitudinal and transverse members 21,22 and glued to the underside of the grout-holding frame 20 by a peelable adhesive that will enable the frame 20 to subsequently be peeled away from the grout strips 23, leaving them in place along the top edges of the base matrix frame 1 walls 2,3,4.

15 Referring to Figure 2, the illustrated grout-holding frame 20 is shown as not having any member 21, 22 extending along its near side or right hand end as viewed and the transverse members 22 that terminate at the nearside edge and longitudinal members 21 that terminate at the right hand edge when positioned on the base matrix frame 1 are foreshortened so that they only partially overlap or reach but do not overlap the corresponding border walls 4 of the base matrix frame 1. This is to allow for close adjacent placement of the next adjoining base matrix frame 1 and associated next adjacent grout-holding frame 20. For the same reason, at the outer borders 4 of the illustrated base matrix frame 1 (rear edge and left-hand edge as viewed), the grout-holding frame 20 and associated grout strip 23 overhang.

20 Accordingly, when a first base matrix frame 1 is butted to a second base matrix frame 1, the grout-holding frame 20 of one overlaps the top edges of the front and right border walls 4 of the other. The grout strips 23 although only shown on part of the grout-holding frame 20 in Figure 2 do extend throughout the grout-holding frame 20. Furthermore, the grout strips 23 are shown as spreading beyond the sides of each grout-holding frame member 21,22 to which they are mounted thereby defining an overhang portion 24 of the grout strip 23 on each side of each member 21,22 of the grout-holding frame 20. This overhang portion 24 is important to serve as an anchor that beds the grout strip 23 into the concrete during the next stage of the procedure in which the wet concrete is poured into the base matrix frame 1

35

compartments 5 (see Figure 5). The grout strip 23 can be of an upstanding/ vertical nature straddling the base matrix frame 1 walls 2,3,4.

Although the overhang 24 of the grout strips 23 is illustrated in Figure 5 as extending substantially perpendicularly from the strips 23, i.e. perpendicularly to the partitioning 2,3 and border 4 walls of the base matrix frame 1, an alternative preferred arrangement is to have them extending inclined at least somewhat downwardly into the respective compartments 5. A downward angling of the overhangs 24 of the grout strips 23 will minimise disruption to concrete flow being poured into the compartments 5 and may ensure more uniform spread of the concrete.

Figure 4 illustrates a base matrix frame 1 and associated grout-holding frame 20 that are particularly suited for use as edging to a paved area. As can be seen, the base matrix frame 1 and grout-holding frame 20 are not only with distinctive curved form of a single row of compartments 5 but it would also be noted that the grout-holding frame 20 fits neatly flush with the base matrix frame 1 throughout, i.e. the grout-holding frame 20 does not extend beyond the base matrix frame on one side and fall short of it on the other, unlike the previously described embodiment. The edging does not need to be seen to be integral with the main area of paving and; accordingly, there is no need for overlap of the grout strips 23 between one base matrix frame and associated grout-holding frame and the next.

Although not shown in Figure 4, the outer boundary wall 4 of the edging base matrix frame 1 is suitably provided with a blanking strip extending the length of the outer boundary wall 4 to close off the apertures/crenel recess 10 to prevent leakage of concrete beyond the edging border.

In a first preferred procedure for laying concrete paving using the apparatus of the invention, the preparative stages are, as conventional, to firstly build up a bed of hardcore on the ground to be paved and to level the hardcore before then spreading across the top of the hardcore a sand screed. Once this is done the base matrix frames 1 are then placed on top of the screeded surface in the desired arrangement to cover the area to be paved. Adjacent base matrix frames 1 are clipped together with the clips and a corresponding grout-holding frame 20 is fitted on top of each base matrix frame 1. As discussed previously, the grout-holding frames 20 will

generally overlap the base matrix frames 1 along two edges, integrating the whole assembly.

The cement mix freshly prepared is suitably deposited in each of the compartments 5, suitably by advancing a wheelbarrow of fresh concrete out over the area to be paved riding on boards laid across the top of the frame assembly 1, 20, and filling the compartments up to a level that is close to being flush with the tops of the grout-holding frames 20. A coloured powder is suitably then applied to the exposed upper concrete layer then smoothed, suitably by trowel, to give the paving the desired colour finish.

Once the colour mix has been added to the concrete and before the concrete sets, a desired surface pattern is generally then imprinted in the concrete using a contoured roller or other suitable imprinting tool of which there are many currently available and used in conventional pattern-imprinted concrete laying.

Once the concrete has substantially set the grout-holding frame 20 is then detached from the grout strips 23 leaving them behind and embedded in the concrete in exactly the configuration dictated by the frames 1, 20, between each of the concrete blocks defined by the frame compartments.

Following removal of the grout-holding frames 20, the concrete will, on average, set within a couple of days enabling the paving to be walked upon or driven upon. An acrylic sealant is suitably applied to the top of the concrete when it has substantially set in order to protect the concrete surface and grout from weathering and enhance the finished appearance, and to enable oil and dirt to be removed easily.

As can further be seen from Figure 5, the skeleton of the grout-holding frame 20, suitably formed of compacted card, has a clearly defined profile/transverse sectional shape which is responsible for giving the exposed upper edges of the concrete blocks a desired shape, in this case, a rounded shape. In particular it will be seen that the profile/section of each grout-holding frame member 21, 22 is of a fluted form, giving rise to the round-edged form of the top of the blocks 25. It will also be appreciated that the size and shape of the grout-holding frame 20 skeleton determines the size shape and depth of the channel between each block when the grout-holding frame 20 is removed, leaving the grout strips 23 behind. On average

the preferred depth of channel to be formed is between 3mm and 5mm and the preferred thickness of grout 23 may be of the order of 3mm. However this can vary depending on the pattern and style of pattern which can include varying shapes and sizes such as cobble, slate, stone, tile, brick etc.

5

The concrete is linked throughout as a substantially monolithic structure by virtue of the concrete bridges formed by the concrete flow between compartments through the apertures of the crenellation recesses 10 or other apertures that extend through the partitioning or boundary walls 2,3,4 of the base matrix frames 1.

10

As time passes, the degradable base matrix frames 1 will disintegrate leaving the interlinked blocks with substantial voids between them that function as shear and expansion lines. All blocks will be connected or touching on shearing maintaining stability, preventing spreading or sideways movement.

15

Significantly, the bridging concrete between the blocks not only gives the paving structural integrity, it also provides support to the overlying grout strips. Indeed, the bridging concrete would generally be sufficient to prevent even a woman's stiletto heel from penetrating between the blocks. However, as a further safeguard against this, the bridging concrete between blocks can be strategically configured by further refinements to the base matrix frame 1 construction as illustrated in Figure 8.

20

Referring to Figure 8, this shows the boundary wall 4 of one base matrix frame 1 in position butting up against the corresponding adjacent boundary wall 4 of an adjoining base matrix frame 1 and where the crenellations 10 along the top edge of each border wall 4 are staggered relative to each other. In consequence, a raised portion 11 of the crenellation of one base matrix frame 1 lies directly next to and therefore obstructs the crenel/recess 10 of the next base matrix frame 1 preventing through-flow of concrete but providing the basis for staggered concrete projections to be formed in the recesses 10 to give support to the overlying grout strip for the full length of the border wall. Accordingly, once the border wall has disintegrated the concrete support immediately underlying the grout strip remains.

30

To compensate for loss of through-flow of bridging concrete through the crenel recesses 10, separate throughflow apertures 10' are provided through the border walls 4 lower down, as illustrated.

35

Whereas the Figure 8 arrangement is described and illustrated with respect to the border walls 4, this arrangement applies equally to the partitioning walls 2,3 and can most readily be used with them when the partitioning walls 2,3 are formed as two-ply or double thickness walls whereby one half of their thickness is crenellated in a first sequence, and the other half of their thickness is crenellated in a second sequence that is staggered relative to the first sequence. By this means all upper edges of all walls, both border 4 and partitioning 2,3 of each base matrix frame 1 have the desired staggered configuration of crenellations to provide uniform support throughout to the corresponding overlying grout strips 23.

In the above described procedure, while laying the cement, we have suggested that the cement mix be poured into the compartments 5 of the base matrix frame 1 once the grout-holding frame 20 is in place and is then topped off with coloured powder. In a refinement to this process to minimise any risk of uncoloured areas two different alternative procedures may be adopted. In the first alternative the assembly of base matrix frames 1 is installed and plain concrete poured into the compartments 5 prior to mounting the grout-holding frames 20 and then filling these with coloured concrete mix. Indeed, it is this embodiment that is illustrated in Figure 5 where one can clearly see the top layer 26 of colour mix concrete above the base matrix frame 1, within the grout-holding frame 20.

In a second alternative procedure, instead of using plain concrete with a coloured powder or colour mix, a fully coloured concrete mix may be used alone and be poured into the fully assembled base matrix frame 1 and grout holding frame 20 assembly to be level with the top of the grout-holding frame 20. This option is the simplest to implement but is subject to the somewhat higher costs of having enough pigment to colour the concrete throughout rather than simply the topmost layer.

In the above described embodiments the grout-holding or channel forming frame 20 is described as holding grout to be left *in situ* overlying the walls 2,3,4 of the corresponding base matrix frame 1. Alternatively, however, the grout channel forming frame 20 need not hold a grout material itself but may be a frame that still has the corresponding plan shape to the plan shape of the base matrix frame 1 but serves solely to form the grout channels between the compartments 5, i.e. between the paving blocks as they are formed, and which is removed once the concrete has

substantially set. Separate grouting material, e.g. a wet or powder grout, may then be placed into the grout channels between the blocks left behind following removal of the grout channel forming frame 20.

5 Turning now to Figure 6, this illustrates an alternative embodiment of the invention in which the base matrix frame 1 is substantially as in the previously described embodiment but which differs significantly in that the topmost surface of the paving comprises preformed paving tiles, suitably preformed of concrete and/or resin, and the grout-holding frame 20 being replaced by a grout frame 30 that functions as the
10 grout itself and which is left *in situ* during the laying process. Grout frame 30 is similar in plan to the grout-holding frame 20 of the first embodiment and is suitably simply formed of grout medium and has, as illustrated, a cross-section that is suitably rectangular, being of a width equivalent to the width of the partition walls 2,3 or border walls 4 of the base matrix frame 1 to directly overlie those walls 2,3,4. As
15 with the grout-holding frame 20, the frame 30 is, however, suitably configured to provide overlap from one base matrix frame 1 to the next. Here, the concrete tiles 31 are formed of a profile having an overhang lip 34 on all sides to seat on top of the correspondingly positioned member of the grout frame 30.

20 The concrete tiles 31 are suitably each formed with studs 32 on their undersurface to bed into the freshly poured concrete that is first poured into the compartments of the base matrix frame 1. The level of the poured concrete suitably comes to the level of the bottom edge of the grout frame 30, as illustrated, and anchoring of the grout frame 30 is suitably achieved by similar studs 33 provided on the underside of
25 the grout frame 30 that project into the concrete where the concrete has flowed into the crenel recesses 10 of the base matrix frame 1.

The pre-manufactured paving tiles 31 are suitably delivered in pack form. The studs on the undersides of the tiles 31 may be moulded of the concrete from which
30 the tiles are moulded or may be plastics or other suitable material that is compatible with concrete and thereby provides a good long term secure anchoring of the tiles 31 into the poured concrete in the base matrix frame 1.

The procedure for laying this embodiment of paving is suitably to begin by setting
35 out the base matrix frames 1 in the desired configuration of assembly. The concrete is then poured and smoothed off and the grout frames then placed onto the

CLAIMS

1. An apparatus for forming paving from a settable material and which comprises a base frame which, alone or together with an adjacent positioned said base frame,
5 defines a plurality of compartments within which the settable material may be placed to be moulded by the compartments of the base frame(s) into a plurality of blocks, wherein the base frame is adapted to be left in situ.
2. An apparatus as claimed in Claim 1, wherein walls of the base frame(s)
10 between adjacent compartments have one or more apertures therethrough to enable a settable material to flow from one compartment to the next to interlink the paving blocks formed as the settable material sets.
3. An apparatus as claimed in Claim 1 or Claim 2, wherein the base frame is of
15 matrix form defining said plurality of compartments within which the settable material may be placed.
4. An apparatus as claimed in Claim 1, Claim 2 or Claim 3, wherein there are a
20 number of said one or more apertures and these are formed as crenellation recesses in the upper, in use, edge of the wall between the compartments of the base frame(s).
5. An apparatus as claimed in Claim 4, wherein further apertures are formed in
25 the walls between compartments lower down the walls than the crenellation recesses.
6. An apparatus as claimed in Claim 4 or 5, wherein the crenellation recesses in
the walls between compartments are at least partly staggered as they run through
the walls and if fully staggered and thereby occluded are provided only in
30 combination with said further apertures.
7. An apparatus as claimed in any preceding claim wherein one or more
recesses are formed in the walls between compartments lower down the walls than
the upper edges of the walls.

8. An apparatus as claimed in any preceding claim, wherein there is further provided a frame which is of a substantially corresponding shape in plan to the base frame in order to be positioned atop the walls of the base frame in use and which functions as a grout-holding frame or grout channel-forming frame.

5

9. An apparatus as claimed in Claim 8, wherein the frame that mounts atop the base matrix frame is a grout-holding frame carrying on its face that is to be placed atop the base frame a layer of grouting material, which layer of grouting material is releasably held to the grout-holding frame so that it may be left in place between the paving blocks and the grout-holding frame removed.

10

10. An apparatus as claimed in Claim 8, wherein the frame that mounts atop the base frame is a grout channel-forming frame and the frame is formed of or serves as a grouting material.

15

11. An apparatus as claimed in Claims 9 or 10, wherein the grouting material extends beyond the top edge of the grout-holding frame or grout channel-forming frame into the compartments to be embedded in the settable material.

20

12. An apparatus as claimed in any preceding claim, wherein the base frame is of cardboard or other degradable material.

13. A frame which is of a substantially corresponding shape in plan to the base frame of any preceding claim in order to be positioned atop the walls of the base frame in use and which functions as a grout-holding frame or grout channel-forming frame.

25

14. A method of forming a paving from a settable material and which comprises the steps of providing an apparatus as claimed in any preceding claim, laying it on the surface to be paved, positioning the settable material into the compartments of the apparatus and allowing the settable material to set, embedding the base frame(s) of the apparatus in situ in the paving.

30

15. A method as claimed in Claim 14, wherein the method further includes the use of a grout-holding frame with releasable grout, wherein the grout-holding frame

35

is mounted atop the base frame and subsequently removed leaving the released grout behind.

Improved Paving System

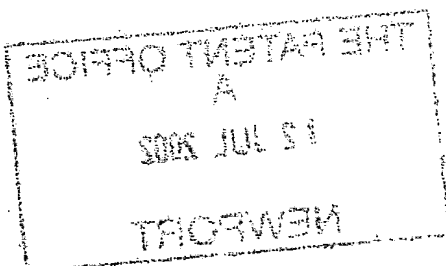
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Abstract

10

The present invention provides an apparatus for forming paving from a settable material and which comprises a base frame which, alone or together with an adjacent positioned said base frame, defines a plurality of compartments within which the settable material may be placed to be moulded by the compartments of the base frame(s) into a plurality of blocks, wherein the base frame is adapted to be left *in situ*.

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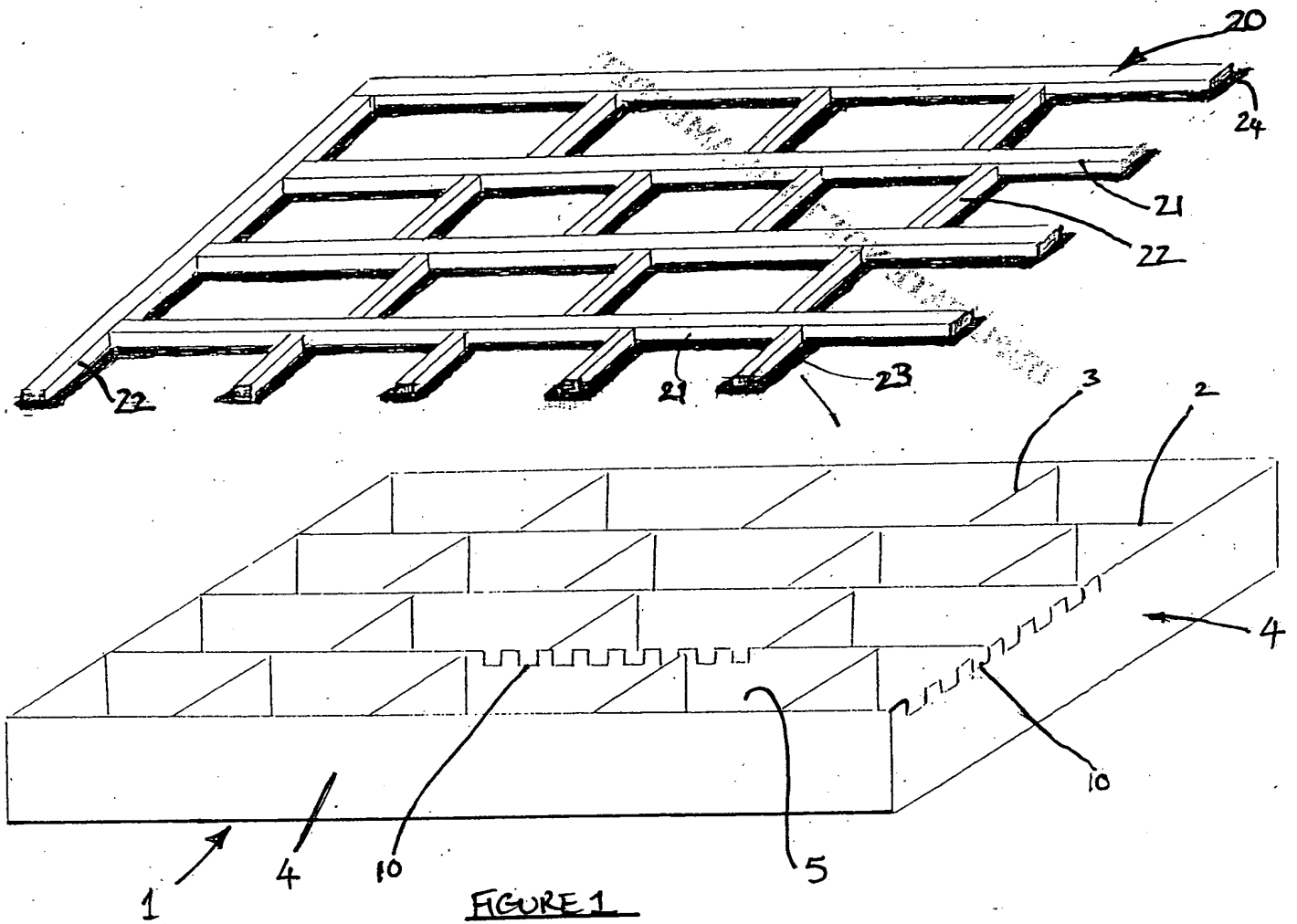


FIGURE 1

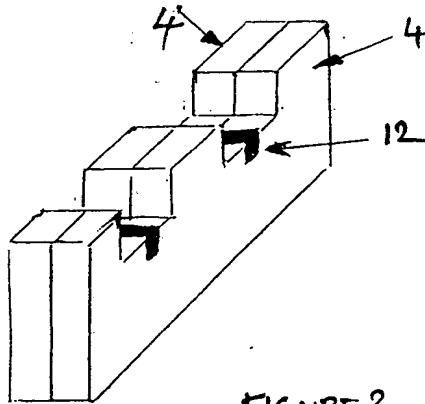


FIGURE 3

2/4

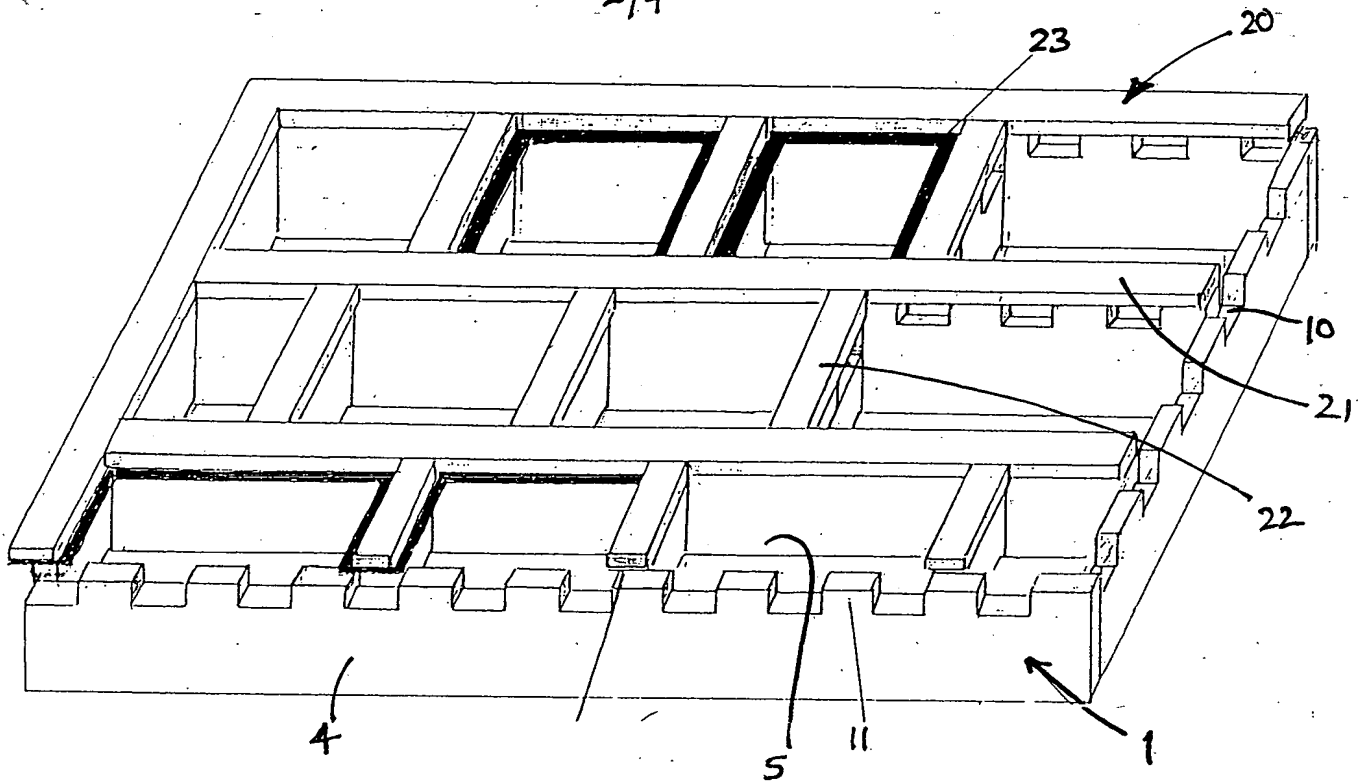


FIGURE 2

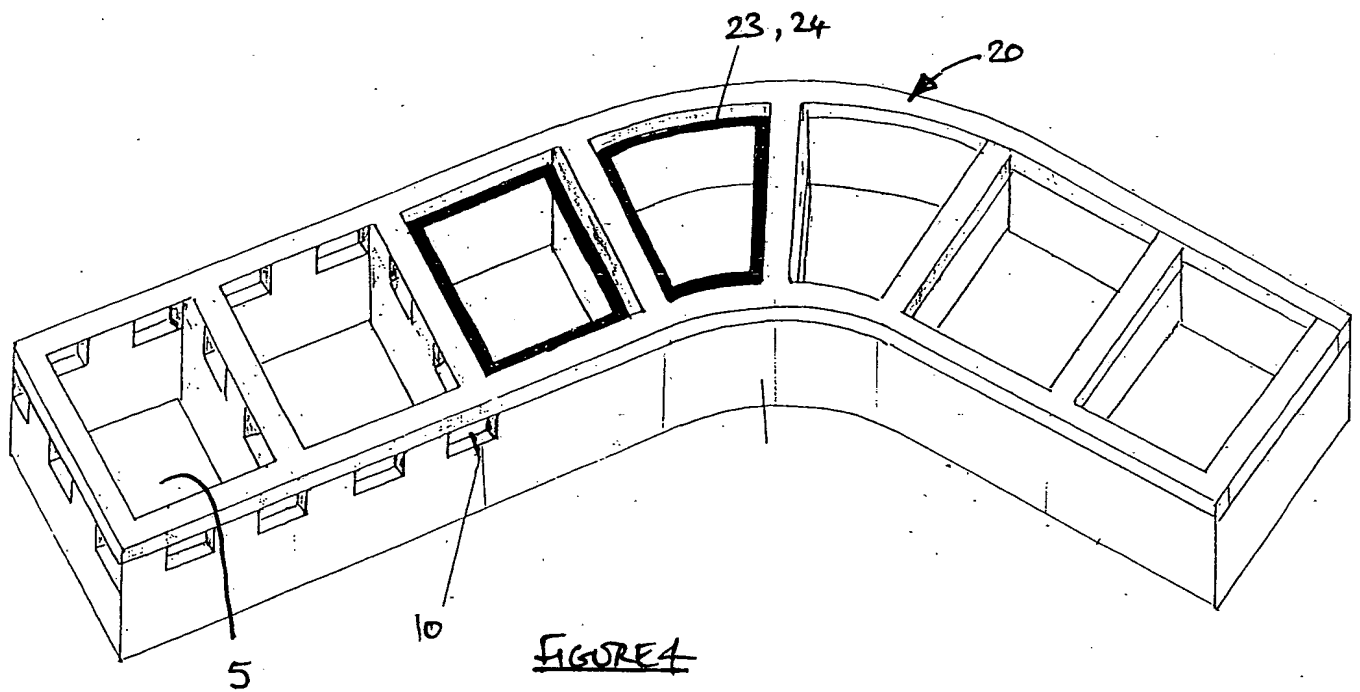


FIGURE 4



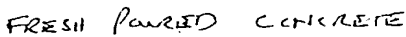
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FIGURE 5

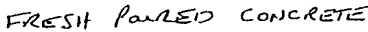
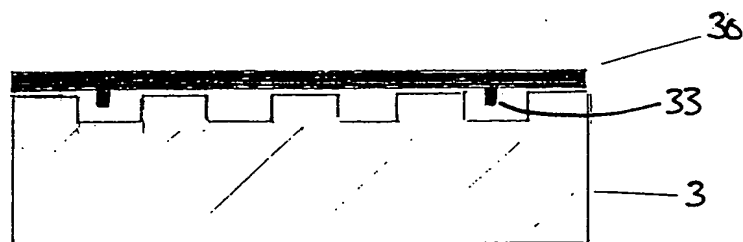


FIGURE 6





4/4

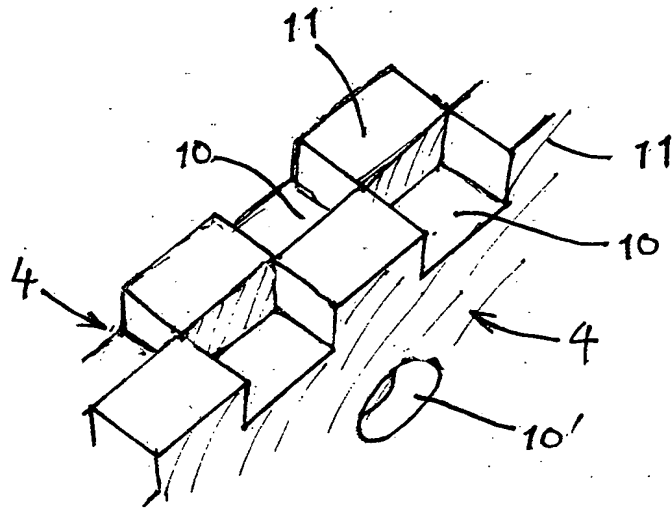


FIGURE 8

